PATENT ABSTRACTS OF JAPAN

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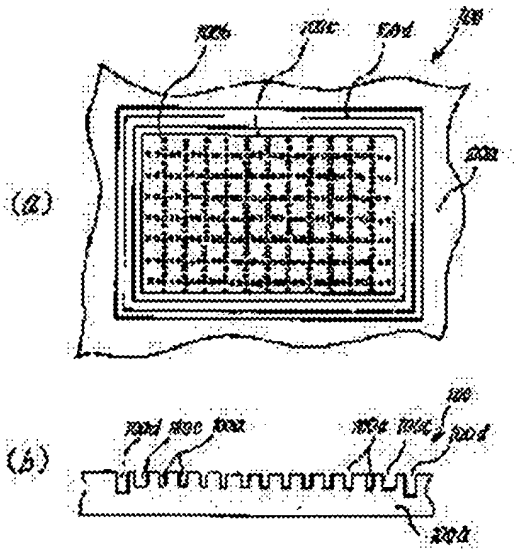
(54) PRODUCTION OF LIQUID CRYSTAL DISPLAY DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To decrease the production cost than a dispersion method or photolithographic method.

SOLUTION: Plural cylindrical recesses 100b are formed into a matrix for the formation of the spacer in a plastic material 100a by using an excimer laser or the like. A second frame-like recess 100c for the formation of liquid crystal sealing which surrounds the region where the cylindrical recesses 100b are formed, and a first frame-like recess 100d surrounding the second frame-like recess 100c for the formation of the sealing material between substrates are formed in the same process to obtain a plastic master plate 100 as an intaglio printing plate. The liquid crystal display device is produced by carrying out a process of filling the recesses of the plastic plate 100 with an UV-curing resin (resin) by using a squeegee device, a process of adhering the resin substrate and a TFT substrate, a process of hardening only the resin, a process of transferring the resin in the recesses to the TFT substrate, a process of laminating the TFT substrate with CF substrate, and a process of hardening the resin to seal both substrates.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the liquid crystal display manufacture approach for manufacturing the liquid crystal display used for pocket television, a computer, a word processor, a personal computer, etc., and relates to amelioration of the shaping approach of sealing agent ** for closing liquid crystal in detail between the spacer which intervenes between the substrates of a liquid crystal display, and this substrate.
[0002]
[Description of the Prior Art] Many of conventional liquid crystal displays are piled up so that and two transparence substrates which have a transparent electrode may counter a field mutually, liquid crystal is enclosed by the gap between these two substrates, and it is constituted. [while] This gap is held by the spacer which intervenes between two substrates, and the closure of the liquid crystal enclosed with this gap is carried out with the sealing agent formed by techniques, such as dispensing which used the syringe. Generally liquid crystal is poured in between two substrates from the narrow liquid crystal inlet established in some sealing agents. However, since the liquid crystal impregnation from this liquid crystal inlet is difficult in the case of the liquid crystal display using a hyperviscous ferroelectric liquid crystal, after a ferroelectric liquid crystal is supplied on substrate of one of the two, both substrates may pile up.
[0003] As a spacer, two or more spherical spacers which consist of a bulb, a glass fiber ball, a silicon ball, etc. are used, and these spherical spacers are distributed by blasting etc. between substrates.
[0004] However, when a spherical spacer is used, the touch area of each substrate and a spherical spacer is made small, and it is made for the stress impressed to each substrate from the exterior to be caught in the minute field near a point or a line. Consequently, sink a spherical spacer into each substrate, or a spherical spacer is made to transform into it, and the magnitude of the above-mentioned gap may be changed to it. And there was fault of disturbing a display image by this change.
[0005] Moreover, after supplying the ferroelectric liquid crystal on substrate of one of the two, when piling up both substrates, even if it carried out equal distribution of many spherical spacers on the substrate, the spherical spacer was moved by supply of a ferroelectric liquid crystal, and there was fault of breaking down an equal distributed condition.
[0006] On the other hand, a frame-like sealing agent is fabricated in the periphery section of one of the two's substrate by print processes, two or more spacers are formed on the substrate of another side by the photolithography method, and after a ferroelectric liquid crystal is dropped on substrate of this one of the two and piling up both substrates, the liquid crystal display manufacture approach of stiffening this sealing agent is learned. According to this liquid crystal display manufacture approach, since the spacer of a desired configuration can be formed by the photolithography method, the touch area of each substrate and a spacer is enlarged, a spacer can cave in and the above-mentioned fault by ****** can be reduced. Moreover, the location of a spacer is not changed, even if it piles up both substrates after supplying a ferroelectric liquid crystal on substrate of one of the two since a spacer is fixable on a substrate.
[0007] However, in this liquid crystal display manufacture approach, since the sealing agent of the substrate periphery section is stiffened after piling up both substrates, there was a possibility of having contacted non-hardened a sealing agent and a ferroelectric liquid crystal, and denaturing this ferroelectric liquid crystal.
[0008] Then, in JP,6-194615,A, the liquid crystal display manufacture approach which forms the sealing agent of the magnitude which carries out coincidence formation of two or more spacers and the frame-like spacer surrounding the formation field of this spacer on substrate of one of the two, and can surround this frame-like spacer on one of substrates by the photolithography method is proposed. According to this liquid crystal display manufacture approach, it is avoidable with the frame-like spacer which made contact to the liquid crystal supplied on the substrate, and a non-hardened sealing agent

intervene among both.
[0009]
[Problem(s) to be Solved by the Invention] By the way, in the conventional liquid crystal display manufacture approach using a spherical spacer, since the sealing agent forming cycle which fabricates the sealing agent other than a spherical spacer distribution process was needed, there was a problem that the production process of equipment became complicated and became cost quantity.
[0010] Moreover, also in the liquid crystal display manufacture approach of above-mentioned JP,6-194615,A which forms a spacer by the photolithography method, since the sealing agent forming cycle which fabricates the sealing agent other than a spacer formation process was needed, there was a problem that the production process of equipment became complicated and became cost quantity.
[0011] Furthermore, the spacer formation process by the photolithography method itself had the problem of becoming cost quantity. Since the greater part of this expensive sensitization resin is further removed at the time of development, while the sensitization resin used as a basis of a spacer is specifically expensive, and basis expense serves as a large sum, much cost is needed for the waste fluid processing produced in development etc., and great cost is required. The photolithography method is a technique chiefly used for manufacture of microcircuit etc. from realizing dimensional accuracy of under 1 [mum]. However, in spacer formation of a liquid crystal display, it is [that what is necessary is just to secure the spacer dimensional accuracy of number [mum] extent] uneconomical to use the expensive photolithography method.
[0012] The place which this invention is made in view of the above background, and is made into the purpose is offering the liquid crystal display manufacture approach the manufacturing cost of a liquid crystal display being reduced, rather than the conventional liquid crystal display manufacture approach of making a spacer intervening among both substrates by the variational method or the photolithography method.
[0013] moreover, ****** made into the 2nd purpose -- the 1st purpose of the above -- in addition, it is offering the liquid crystal display manufacture approach which can cancel faults, such as the denaturation of this liquid crystal produced by contact to a non-hardened sealing agent and liquid crystal.
[0014]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, invention of claim 1 In the liquid crystal display manufacture approach for manufacturing a liquid crystal display equipped with the liquid crystal enclosed with the gap formed between two substrates, and the sealing agent for closing this liquid crystal between these substrates two substrates which counter through two or more spacers -- this -- Like the packer who fills up with a basis each crevice of the intaglio which has two or more crevices for forming this spacer, and a frame-like crevice surrounding the formation field of this crevice The adhesion process at which the basis with which it was filled up, and one substrate are stuck, and the 1st hardening process which stiffens only the basis in this crevice, The imprint process which detaches this intaglio and one [this] substrate and imprints a hardened basis and the non-hardened basis fabricated in the shape of a frame on one [this] substrate, It is characterized by carrying out the superposition process which piles up one [this] substrate and another substrate, and the 2nd hardening process which is made to harden this non-hardened basis and forms this sealing agent.
[0015] In the liquid crystal display manufacture approach of claim 1, after filling up each crevice of an intaglio with the basis for forming a spacer etc. and fabricating it first, the basis with which it was filled up, and one of substrates is stuck. Adhesion to the substrate of a basis is promoted by this adhesion. Subsequently, only the basis in crevices other than a frame-like crevice is stiffened, and fixing to the substrate of this basis is promoted. And an intaglio and the substrate of the method of top Norikazu are detached, and a hardened basis and the non-hardened basis fabricated in the shape of a frame are imprinted on one [this] substrate. By this imprint, two or more spacers can be formed on above-mentioned one substrate, and the non-hardened basis of the shape of a frame which is a non-hardened sealing agent can be imprinted on the outside of the formation field of this spacer. And after piling up the substrate which imprinted these spacers and a non-hardened basis with another substrate, this non-

hardened basis is stiffened and both substrates are pasted up. In the above process, formation of two or more spacers and shaping of the above-mentioned non-hardened basis which is a sealing agent can be performed to coincidence. And thereby, a production process can be simplified rather than the conventional liquid crystal display manufacture approach of making a spacer intervening among both substrates by the variational method or the photolithography method. Moreover, a spacer is arranged by the simple actuation of the imprint of the basis by basis shaping by the restoration to a crevice, the promotion of adhesion to the substrate of this basis by adhesion, the promotion of fixing of this basis by hardening in this crevice, and alienation with this substrate and an intaglio. Thereby, the arrangement cost of this spacer can be reduced rather than the case where a spacer is arranged on a substrate by the variational method or the photolithography method. In addition, it is also possible to fill up a solid basis into the crevice of an intaglio with using the RIMERUTO process-technique.

[0016] In the liquid crystal display manufacture approach of claim 1, invention of claim 2 prepares the 2nd frame-like crevice surrounding the formation field of this crevice between the above-mentioned crevice of the above-mentioned intaglio, and the above-mentioned frame-like crevice, is the above-mentioned 1st hardening process, and is characterized by stiffening the basis in this crevice and this 2nd frame-like crevice.

[0017] In this liquid crystal display manufacture approach, the frame-like spacer surrounding the formation field of each spacer on a substrate is formed on this substrate. This frame-like spacer prevents contact, the liquid crystal supplied inside that frame structure, and the non-hardened basis fabricated in the shape of a frame on the outside of this frame structure, i.e., a non-hardened sealing agent.

[0018] Invention of claim 3 is characterized by using the plastics version as the above-mentioned intaglio in claim 1 or the liquid crystal display manufacture approach of 2.

[0019] In this liquid crystal display formation approach, are an adhesion process, the plastics version is made to follow and transform into irregularity with a delicate substrate front face using the plastics version which excels the metal version in flexibility as an intaglio, and the adhesion on an intaglio and the front face of a substrate is raised. By improvement in such adhesion, the omission nature of the basis with which it was filled up in each crevice can be raised, and deformation of this basis produced at an imprint process and the residual in a crevice can be reduced.

[0020] Invention of claim 4 is characterized by using what demonstrates elasticity after hardening as the above-mentioned basis in claims 1 and 2 or the liquid crystal display manufacture approach of 3.

[0021] The spacer which has elasticity can be formed and the sealing agent after hardening can be made to demonstrate elasticity in this spacer formation approach for liquid crystal displays in this liquid crystal display formation approach.

[0022] Invention of claim 5 is claims 1, 2, and 3 or the liquid crystal display manufacture approach of 4, and the above-mentioned basis is a photoresist paste and it is characterized by carrying out the optical exposure only of this photoresist paste in the crevice for spacer shaping, and hardening in the above-mentioned 1st hardening process.

[0023] In this liquid crystal display manufacture approach, only the photoresist paste in each crevice is stiffened by optical exposure, using a photoresist paste as a basis. For this reason, hardening of the photoresist paste made to adhere to the perimeter of each crevice by blot etc. is avoidable.

[0024] Invention of claim 6 is the liquid crystal display manufacture approach of claim 5 which uses the above-mentioned plastics version as the above-mentioned intaglio, and is characterized by the protection-from-light layer which consists of plastics material in which the above-mentioned plastics version has light transmission nature, and has protection-from-light nature being covered by parts other than the crevice of the crevice formation side front face of this plastics version.

[0025] It is the crevice formation side front face (henceforth a restoration side) of this plastics version with the ingredient which constitutes the plastics version from plastics material which has light transmission nature in this liquid crystal display manufacture approach, and has protection-from-light nature. Moreover, parts other than a crevice called an exposure side in the field of the opposite side are covered. Thus, even if it piles up the restoration side and substrate of the plastics version by constituting, an optical exposure can be easily carried out from the exposure side of this plastics version to the

photoresist paste with which each crevice of this plastics version was filled up.
[0026] Invention of claim 7 is the liquid crystal display manufacture approach of claim 6, and is characterized by the 2nd protection-from-light layer which has protection-from-light nature being covered by the opposite part with the above-mentioned frame-like crevice [in / in the crevice formation side front face of the above-mentioned plastics version / the front face of the opposite side].
[0027] By this liquid crystal display manufacture approach, in the 1st hardening process, while shading the photoresist paste in the above-mentioned frame-like crevice by the 2nd protection-from-light layer, an optical exposure is carried out to the photoresist paste for spacer formation in the above-mentioned crevice and the above-mentioned 2nd frame-like crevice. For this reason, in the above-mentioned 1st hardening process, an optical exposure can be carried out only to the photoresist paste for spacer formation.
[0028]
[Embodiment of the Invention] Hereafter, the operation gestalt of the liquid crystal display manufacture approach which applied this invention is explained. Drawing 1 is the sectional view showing the outline configuration of the TFT-liquid-crystal display manufactured by this liquid crystal display manufacture approach. In drawing 1 , the laminating of the scan signal line 4, a video-signal line (not shown), TFT (thin film transistor) 6, the lower orientation film 7, and the transparent ITO (indium tin oxide) pixel electrode 3 grade is carried out on the transparent TFT substrate 1 as a substrate which consists of a glass plate etc. The lower orientation film 7 is for arranging the sense of a liquid crystal molecule, and the countless blemish which extends in the predetermined direction is given to the front face. TFT6 is for controlling ON/OFF of the impression of a pixel electrical potential difference to the ITO pixel electrode 3, and consists of semi-conductor 6b which consists of gate electrode 6a, amorphous silicon, etc., the source / drain electrode pair 6c, etc.
[0029] Moreover, on the transparent CF substrate 2 as a substrate, the laminating of the color filter 8 colored green (G), blue (B), or red (R), the black matrix 9 which shades fields other than each pixel field between the TFT substrate 1 and the CF substrate 2, the ITO counterelectrode 10 which is a common electrode corresponding to all the ITO pixel electrodes 3, and the up orientation film 11 grade is carried out. The ITO counterelectrode 10 is formed by ITO like the ITO pixel electrode 3, and is transparent. The countless blemish to which the up orientation film 11 extends in the predetermined direction like the lower orientation film 7 is given to the front face.
[0030] Furthermore, polarizing plates 12 and 13 are stuck on the field (respectively non-opposed face) of the outside of the TFT substrate 1 and the CF substrate 2, respectively. These two polarizing plates are arranged so that the polarization shaft of a polarizing plate may intersect perpendicularly mutually, and they do not penetrate light according to the sense of liquid crystal. In addition, it is a deflecting plate 12, and also, outside, the back light (not shown) is arranged.
[0031] Between the lower orientation film 7 and the up orientation film 11, the ferroelectric liquid crystal 15 as liquid crystal is enclosed. In the field between the ITO pixel electrode 3 and the ITO counterelectrode 10, this ferroelectric liquid crystal 15 changes the sense according to an operation of the electric field produced in both potential difference, and deflects the light from a back light. The cylindrical spacer 14 as a spacer intervenes between the lower orientation film 7 and the up orientation film 11. The gap for making liquid crystal intervene between the TFT substrate 1 and the CF substrate 2 is held by this mediation.
[0032] Drawing 2 is the top view showing the important section of this TFT-liquid-crystal display. In drawing 2 , the alphabet given to each pixel 16 shows the color of a color filter 8. Moreover, the part which attached the slash is a field where a back light is shaded by the black matrix 9, and serves as a non-pixel field. Each pixel 8 is carrying out the configuration which made the part of a rectangular lower left corner suffer a loss. TFT6 (not shown) is arranged directly under the part (part shown by the arrow head A) of this lower left corner, respectively. moreover -- directly under [of the black matrix 9 which divides each pixel 16] -- the direction of a drawing train -- the scan signal line 4 and a drawing line writing direction -- a video-signal line -- ********** arrangement is carried out. The cylindrical spacer 14 is formed in the non-pixel field [directly under] of the black matrix 9 shown in drawing 1 by this

liquid crystal display manufacture approach. Thus, it is desirable to set to the liquid crystal display manufacture approach concerning this invention, and to form a spacer in the non-pixel field between two substrates. Thereby, turbulence of the display image of the liquid crystal display by a spacer existing in a pixel field is avoidable.

[0033] Drawing 3 (a) is the top view showing the important section of the plastics version 100 as an intaglio used for this liquid crystal display manufacture approach, and drawing 3 (b) is the sectional view showing this important section. In addition, in drawing 3 (b), the thickness of the plastics version 100 is drawn greatly for convenience. In drawing 3 , the printing pattern set to plastics material 100a from two or more crevices, the protection-from-light layer, etc. are formed in the plastics version 100. Plastics material 100a is formed by transparent plastics material, and penetrates ultraviolet rays (henceforth UV). Two or more cylindrical crevice 100b as a pillar-shaped crevice is formed in the restoration side (top side of drawing 3 (b)) of plastics material 100a in the shape of a matrix. Moreover, 100d of 1st frame-like crevices as a frame-like crevice surrounding 2nd frame-like crevice 100c surrounding this formation field and this 2nd frame-like crevice 100c is formed in the outside of the formation field of this cylindrical crevice 100b. In addition, although the depth of cylindrical crevice 100b and 2nd frame-like crevice 100c is the same, 100d of 1st frame-like crevices is formed more deeply than these.

[0034] Cylindrical crevice 100b is formed in the field corresponding to the black matrix opposite field on the below-mentioned TFT substrate 1 in the plastics material 100a top.

[0035] Around each crevice in the restoration side of plastics material 100a, protection-from-light layer 100e is covered. Moreover, 100f of protection-from-light layers is covered by the 100d [of 1st frame-like crevices in the exposure side of plastics material 100a] opposite part. It is opaque, and these protection-from-light layers 100e and 100f are formed with hard, the titanium oxide which has abrasion resistance, and have protection-from-light nature.

[0036] In the liquid crystal display manufacture approach of this operation gestalt, the elastomer mold ultraviolet-rays hardenability resin paste (henceforth UV hardenability paste) which can demonstrate elasticity is used after hardening as a basis for forming a spacer and a sealing agent. The spacer which has elasticity can be formed by this, and the sealing agent after hardening can be made to demonstrate elasticity.

[0037] Drawing 4 (a) to (g) is a sectional view explaining from the packer of UV hardenability paste in this liquid crystal display manufacture approach degree to an imprint process, to (a) to (c), (f) shows the 1st hardening process and, as for (g), (e) shows an imprint process like a packer for an adhesion process, respectively. In drawing 4 , UV hardenability paste 101 is first supplied by the paste feeder (not shown) on the restoration side of the plastics version 100 (a). And skiing JINGU of the UV hardenability paste 101 is carried out by the squeegee 102 at the plastics version 100 (b). Each cylindrical crevice 100b of the plastics version 100, 100d of 1st frame-like crevices, and 2nd frame-like crevice 100c are filled up with UV hardenability paste 101 by this skiing JINGU, respectively (c).

[0038] Hereafter, UV hardenability paste 101 fabricated by the cylindrical shape by restoration to each cylindrical crevice 100b is called cylindrical paste 101b for convenience. Moreover, UV hardenability paste 101 fabricated in the shape of a frame by the restoration to 100d of 1st frame-like crevices and 2nd frame-like crevice 100c is called 1st frame-like paste 101d and 2nd frame-like paste 101c, respectively.

[0039] If UV hardenability paste 101 is fabricated by restoration in each crevice next, it will be reversed with a version driving gear (not shown), and will be stuck to the plastics version 100 by the lower orientation film 7 on (d) and the TFT substrate 1 (e: adhesion process). In the case of this adhesion, alignment of the TFT substrate 1 and the plastics version 100 is performed so that each cylindrical crevice 100b may be located above the scan signal line 4 arranged in the non-pixel field, or a video-signal line.

[0040] Cylindrical paste 101b and 1st frame-like paste 101d and 2nd sheep hardening paste 101c are stuck to the non-image field of the lower orientation film 7 by adhesion with the plastics version 100 and the lower orientation film 7, respectively, and adhesion on the lower orientation film 7 is promoted.

[0041] By the way, in the liquid crystal display manufacture approach of this operation gestalt, the

plastics version which excels the metal version in flexibility as an intaglio is used, it is an adhesion process, the plastics version 100 can be made to be able to follow and transform into the delicate irregularity of the orientation film 7 on the TFT substrate 1, and the adhesion of the plastics version 100 and the orientation film 7 on a TFT substrate can be raised. And the omission nature of UV hardenability paste 101 with which it was filled up in each crevice can be raised by improvement in such adhesion, and deformation of UV hardenability paste 101 produced at the below-mentioned imprint process and the residual in a crevice can be reduced.

[0042] In addition, as for each crevice of the plastics version 100, it is desirable to be processed on plastics material 100a by ablation processing which used SR light of excimer laser and the ultraviolet-rays field of a synchrotron etc., respectively. Thus, the wall of each crevice formed of ablation processing is excellent in whether you are Haruka at smooth nature compared with the crevice of other intaglios, and can raise further the omission nature of bases, such as a resin paste with which these were filled up, and deformation of UV hardenability paste 101 produced at an imprint process and the residual in a crevice can be reduced further.

[0043] The UV lamp 103 is arranged above the plastics version 100, and UV110 is irradiated towards the exposure side of the plastics version 100. UV110 from the UV lamp 103 penetrates plastics material 100a, and irradiates cylindrical paste 101b and 2nd frame-like paste 101c (f). However, 100f of protection-from-light layers is covered by the 100d [of 1st frame-like crevices in the exposure side of plastics material 100a] opposite part, and UV irradiation is not shaded and carried out in 100f of this protection-from-light layer non-hardened paste 101d. Moreover, protection-from-light layer 100e is covered by the perimeter of each crevice in the restoration side of plastics material 101a, and the UV irradiation of the UV hardenability paste 101 which adhered to the perimeter of opening of each crevice by blot etc. is not shaded and carried out to it by this protection-from-light layer 100e.

[0044] It hardens, while cylindrical paste 101b by which UV irradiation was carried out, and 2nd frame-like paste 101c stick with the lower orientation film 7, and fixing to the lower orientation film 7 is promoted. Moreover, it contracts by hardening and the omission nature from cylindrical crevice 100b or a 1st frame-like crevice improves. Furthermore, it hardens a cylindrical shape and in the shape of a rectangle frame by carrying out UV irradiation, where the interior of cylindrical crevice 100b or a 1st frame-like crevice is filled up, without deforming with surface tension etc.

[0045] If hardening of cylindrical paste 101b and 2nd frame-like paste 101c is completed or this hardening advances to a predetermined degree, the plastics version 100 will be moved to the drawing bottom by the above-mentioned version driving gear. A TFT substrate and the plastics version 100 estrange by this migration (g: imprint process). The hardened paste and the non-hardened paste in each crevice are imprinted by synergisms, such as improvement in the adhesion by the fixing force of the lower orientation film 7 and UV hardenability paste 101, gravity, and the plastics version 100, good on the lower orientation film 7 in the case of this alienation. the shape of and a frame which surrounds the formation field of two or more cylindrical spacer 101y set up in the shape of a matrix on the non-pixel field of the lower orientation film 7, and this cylindrical spacer 101y by this imprint -- spacer 101x are formed. moreover, 1st frame-like paste 101d as a non-hardened sealing agent -- a lower orientation film top -- the shape of this frame -- it is fabricated in the shape of a rectangle frame so that spacer 101x may be surrounded.

[0046] Drawing 5 (a) to (d) is a sectional view explaining from the liquid crystal supply process in this liquid crystal display manufacture approach to the 2nd hardening process, (c) shows a superposition process and, as for (d), (a) and (b) show the 2nd hardening process for a liquid crystal supply process, respectively. In addition, in each drawing of drawing 5 , illustration of the ITO pixel electrode 3, the scan signal line 4, TFT6, a color filter 8, the black matrix 9, and the ITO counterelectrode 10 is omitted for convenience.

[0047] the shape of a frame [set to drawing 5 and / feeder / (not shown) / liquid crystal / ferroelectric liquid crystal / 15] on the lower orientation film 7 of a TFT substrate first -- (a) supplied inside [frame structure] spacer 101x (only henceforth the inside). and this ferroelectric liquid crystal 15 -- the shape of a frame -- (b) filled inside spacer 101x. under the present circumstances, illustration -- like -- the shape

of a frame -- spacer 101x prevent contact to the ferroelectric liquid crystal 15 supplied inside that frame structure, and 1st frame-like paste 101d which is the non-hardened sealing agent fabricated by the outside of this frame structure.

[0048] When using the liquid crystal of the usual viscosity, liquid crystal may be supplied by other approaches. concrete -- the TFT substrate 1 top -- the shape of a frame -- the ** which does not prepare spacer 101x -- a part of ****** hardening paste 101d frame structure -- liquid crystal enclosure opening -- preparing -- the TFT substrate 1 and the CF substrate 2 -- superposition -- since ****** hardening paste 101d is stiffened further, you may make it enclose liquid crystal from this liquid crystal enclosure opening However, to use the hyperviscous ferroelectric liquid crystal 15, enclosure from the above-mentioned liquid crystal enclosure opening may be very difficult, and before piling up both substrates like this operation gestalt in such a case, it is necessary to supply a ferroelectric liquid crystal 15 to one of substrates.

[0049] If a ferroelectric liquid crystal 15 is filled inside cylindrical spacer 101x next, the TFT substrate 1 and the CF substrate 2 which has the laminating of up orientation film 11 grade will pile up (c). By this superposition, ****** hardening paste 101d with length longer than each spacer sticks to both between the lower orientation film 7 and the up orientation film 11. And UV irradiation is carried out from the deflecting plate 13 side of the CF substrate 2 with the UV lamp 103, and it hardens (d). By this hardening, ****** hardening paste 101d fixes on the lower orientation film 7 and the up orientation film 11, pastes up the TFT substrate 1 and CF substrate, and closes a ferroelectric liquid crystal 15.

[0050] In a series of above processes, formation of cylindrical spacer 101y and shaping of ****** hardening paste 101d which is a sealing agent can be performed to coincidence to the lower orientation film 7. And thereby, the production process of a liquid crystal display can be simplified rather than the conventional liquid crystal display manufacture approach of making a spacer intervening between two substrates by the variational method or the photolithography method. Moreover, cylindrical spacer 101y is arranged by the simple actuation of shaping of UV hardenability paste 101 by the restoration to each crevice of the plastics version 100, the promotion of adhesion to the lower orientation film 7 of UV hardenability paste 101 by adhesion, the promotion of fixing of UV hardenability paste 101 by hardening in each crevice, and the imprint of a hardened paste. Thereby, the arrangement cost of this spacer can be reduced rather than the case where a spacer is arranged on a substrate by the variational method or the photolithography method. Moreover, UV hardenability paste 101 made to adhere to the perimeter of each crevice by blot etc. can be shaded by protection-from-light layer 100e in the 1st hardening process, and hardening of this UV hardenability paste 101 can be avoided. Moreover, even if it piles up the plastics version 100 and the TFT substrate 1 by using plastics material 100a which has permeability, in the 1st hardening process, UV irradiation can be easily carried out from a plastics version 100 exposure side to cylindrical paste 101b and 2nd frame-like paste 101c. Furthermore, by preparing 100f of protection-from-light layers, 1st frame-like paste 101d can be shaded in the 1st hardening process, and UV irradiation can be carried out only to cylindrical paste 100b and 2nd frame-like paste 101c.

[0051] As mentioned above, since according to the liquid crystal display manufacture approach of this operation gestalt the production process of a liquid crystal display can be simplified and the arrangement cost of a spacer can be reduced rather than the conventional liquid crystal display manufacture approach of making a spacer intervening between two substrates by the variational method or the photolithography method, the manufacturing cost of a liquid crystal display can be reduced rather than the conventional liquid crystal display manufacture approach. Moreover, even when using the approach of supplying the hyperviscous ferroelectric liquid crystal 15 on one of substrates before piling up two substrates since contact to a ferroelectric liquid crystal 15 and 1st frame-like paste 101d which is a sealing agent is avoided, faults, such as the denaturation of the liquid crystal produced by this contact, can be canceled. Moreover, since deformation of UV hardenability paste produced at an imprint process and the residual in a crevice can be reduced, a spacer with high configuration precision and dimensional accuracy can be formed, and a sealing agent with high configuration precision and dimensional accuracy can be fabricated. moreover, the shape of cylindrical spacer 101y which has elasticity, and a frame --

since spacer 101x are formed and the sealing agent after hardening is made to demonstrate elasticity, fatigue breaking of each spacer or this sealing agent can be reduced. moreover -- since hardening of UV hardenability paste 101 made to adhere to the perimeter of each crevice by blot etc. is avoidable -- the shape of cylindrical spacer 101y with a still higher configuration precision, or a frame -- spacer 101x can be formed. Moreover, since UV irradiation can be easily carried out from a plastics version 100 exposure side to cylindrical paste 101b and 2nd frame-like paste 101c, these can be stiffened easily and it can be made to change to a spacer. Furthermore, in the 1st hardening process, since UV irradiation can be carried out only to cylindrical paste 100b and 2nd frame-like paste 101c, in this 1st hardening process, only these non-hardened pastes can be stiffened easily.

[0052] In addition, it is also possible to fill up a solid basis into each crevice of the plastics version 100 with using the RIMERUTO process-technique. Concrete first, like a RIMERUTO process, the basis is beforehand processed into the cylindrical shape using rough metal mold, and this is supplied to each crevice. And the supplied basis is heated, and the strain of the torsion of the time of an injection, a kink, deflection, etc. is removed, or it changes into a flow condition again. Thereby, it is made to learn from the configuration of each crevice. Subsequently, what is necessary is to choose timing at one's own discretion, to stick this basis in lower orientation film 7 grade, and just to imprint, if a basis starts hardening.

[0053] Moreover, a multiple pilaster spacer can be formed by forming the configuration of cylindrical crevice 100b in multiple pilasters, such as the square pole and a hexagonal prism.

[0054] The liquid crystal display manufacture approach of the example which is a more concrete example of [Example], next the liquid crystal display manufacture approach of the above-mentioned operation gestalt is explained. In this liquid crystal display manufacture approach, formation of each spacer and shaping of ****** hardening paste 101d are performed using spacer formation equipment. The sectional view in which drawing 6 shows the outline configuration of this spacer formation equipment, and drawing 7 are the expanded sectional views explaining the situation of the UV irradiation and hardening in the 1st hardening process of this spacer formation equipment.

[0055] In drawing 6 , the plastics version 100 is formed in the shape of an endless belt as the whole, and it rotates, moving in the drawing Nakaya mark direction with the driving gear 104 on either side. Each crevice where it moved directly under [where conductive processing was performed] the squeegee 102 by this rotation is filled up with UV hardenability paste 101. It moves further and each crevice where it was given like such a packer progresses to adhesion and 1st hardening / imprint process.

[0056] On the other hand, the TFT substrate 1 sent from a front production process passes the black light 105 for surface treatment for improving wettability, is put on the transport device 107 which moves in the surface plate table 106 top, turns the lower orientation film 7 up, and is transported to an adhesion process. The lower orientation film 7 on this TFT substrate 1 and each crevice of the plastics version 100 are mutually stuck, after the amount of location gaps is measured and alignment is performed by the image recognition equipment 108 located in the adhesion process foremost part.

[0057] The roller 109 made from quartz glass with sufficient UV permeability and the ultraviolet ray lamp 103 installed in the internal centrum carry out the UV irradiation of cylindrical paste 101d and the 2nd frame-like paste 101c, and stiffens them. And while it is pushed against lower orientation film 7 front face and adhesion is promoted, hardening advances, and finally these cylindrical shape paste 101d and 2nd frame-like paste 101c fix on the lower orientation film 7.

[0058] On the other hand, 1st frame-like paste 101d, it is shaded in the 100f of the 2nd protection-from-light layers, and does not harden. Moreover, it is shaded by 1st protection-from-light layer 100e, and UV hardenability paste adhering to the perimeter of each crevice in the restoration side of plastics material 100a is not hardened.

[0059] In drawing 7 , the plastics version 100 has stuck on the lower orientation film 7, and UV hardenability paste 101 in each crevice has stuck to this lower orientation film 7. This adhesion is promoted by the welding pressure of the roller 109 made from quartz glass currently pressed from the background of the plastics version 100, and adhesion of UV hardenability paste 101 to the lower orientation film 7 is promoted.

[0060] when the belt of the plastics version 100 moves further, it results in a decollator 112 soon and the belt and the lower orientation film 7 of the plastics version 100 are made to exfoliate here -- having -- the shape of cylindrical spacer 101y and a frame -- spacer 101x and 2nd frame-like paste 101d are imprinted on the lower orientation film 7.
[0061] the plastics version 100 which completed the imprint of UV hardenability paste 101 should pass a driving gear 104 -- the intaglio belt washing station 113 -- setting -- oozing out -- UV hardenability paste which was not hardened -- foreign matters, such as a minute fragment (caret) of glass, are removed especially. After being a cleaning agent in the rinse tub 114 furthermore, rinsing and drying in drying room 115, with the release agent coater 116, processing on a mold release disposition is performed and it returns even like a packer. Thus, the plastics version 100 fabricates the 1st frame-like paste which is a sealing agent while it circulates through an adhesion process, the 1st hardening process, an imprint process, and the tail end process from washing to desiccation and forms repeat each spacer like the head end process of release agent spreading, and the packer of a paste. Thereby, two or more spacer formation and sealing agent shaping to the TFT substrate 1 are automatable.
[0062] Since it responds to setting like a packer among a series of above-mentioned processes, and exfoliation of the plastics version 100 becoming [in / in that restoration is checked by mixing of the air to the contamination and each crevice of a bubble of under UV hardenability paste 101 **** / an imprint process] difficult with an atmospheric pressure, it is desirable to make into a reduced pressure ambient atmosphere or a vacuum the range which includes an imprint process from a packer degree at least. moreover, the thing for which various kinds of electrostatic preventive measures are performed in order to prevent static electricity in process -- desirable -- for example, Io -- it is good to use NAIZA.
[0063] In addition, although the configuration which arranges each spacer and a sealing agent on the lower orientation film 7 has so far been explained, in the liquid crystal display manufacture approach that this invention is applied, the arrangement location of each spacer or a sealing agent is not limited on the lower orientation film 7.
[0064] Moreover, although the liquid crystal display manufacture approach of using a basis of the same kind for a spacer, a frame-like spacer, and a sealing agent altogether was explained, it sets like a packer, masking processing is performed to the crevice which is not a candidate for restoration, it is carrying out by repeating the actuation which fills up only the crevice for restoration with a predetermined basis, and you may make it use the basis of a different class to a spacer, a frame-like spacer, and a sealing agent. Thereby, to a sealing agent, the endurance of a liquid crystal display can be raised [a spacer or a frame-like spacer] using the basis excellent in the adhesive property with both substrates, using the basis excellent in liquid crystallinity-proof.
[0065]
[Effect of the Invention] Since according to invention of claim 1 a production process can be simplified and the arrangement cost of a spacer can be reduced rather than the conventional liquid crystal display manufacture approach of making a spacer intervening among both substrates by the variational method or the photolithography method, there is outstanding effectiveness that the manufacturing cost of a liquid crystal display can be reduced, rather than the case where this liquid crystal display manufacture approach is used.
[0066] According to invention of claim 2, since contact to liquid crystal and a non-hardened sealing agent is prevented, there is outstanding effectiveness that faults, such as the denaturation of this liquid crystal produced by this contact, are cancelable.
[0067] Since deformation of the restoration basis produced at an imprint process and the residual in a crevice can be reduced according to invention of claim 3, a spacer with high configuration precision and dimensional accuracy is formed, and there is outstanding effectiveness that a sealing agent with high configuration precision and dimensional accuracy can be fabricated.
[0068] Since according to invention of claim 4 the spacer which has elasticity can be formed and the sealing agent after hardening can be made to demonstrate elasticity, there is outstanding effectiveness that fatigue breaking of a spacer or a sealing agent can be reduced.
[0069] Since hardening of the photoresist paste made to adhere to the perimeter of each crevice by blot

etc. is avoidable according to invention of claim 5, there is outstanding effectiveness that a spacer with a still higher configuration precision can be formed.

[0070] Since an optical exposure can be easily carried out from the restoration side of this plastics version to the photoresist paste with which each crevice of the plastics version was filled up according to invention of claim 6, this photoresist paste is stiffened easily and there is outstanding effectiveness that a spacer can be formed.

[0071] According to invention of claim 7, since an optical exposure can be carried out only to the photoresist paste for spacer formation in the 1st hardening process, there is outstanding effectiveness that only the photoresist paste for spacer formation can be easily stiffened in this 1st hardening process.

[Translation done.]